

**UNIFORM STANDARD  
SPECIFICATIONS  
for  
PUBLIC WORKS  
CONSTRUCTION**

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**1998  
ARIZONA  
(Includes revisions through 2004)**

## FOREWORD

Publication of these Uniform Standard Specifications and Details for Public Works Construction fulfills the goal of a group of agencies who joined forces in 1966 to produce such a set of documents. Subsequently, in the interest of promoting county-wide acceptance and use of these standards and details, the Maricopa Association of Governments accepted their sponsorship and the responsibility of keeping them current and viable.

These specifications and details, representing the best professional thinking of representatives of several Public Works Departments, reviewed and refined by members of the construction industry, were written to fulfill the need for uniform rules governing public works construction performed for Maricopa County and the various cities and public agencies in the county. It further fulfills the need for adequate standards by the smaller communities and agencies who could not afford to promulgate such standards for themselves.

A uniform set of specifications and details, updated and embracing the most modern materials and construction techniques will redound to the benefit of the public and the private contracting industry. Uniform specifications and details will eliminate conflicts and confusion, lower construction costs, and encourage more competitive bidding by private contractors.

The Uniform Standard Specifications and Details for Public Works Construction will be revised periodically and reprinted to reflect advanced thinking and the changing technology of the construction industry. To this end a Specifications and Details Committee has been established as a permanent organization to continually study and recommend changes to the Specifications and Details. Interested parties may address suggested changes and questions to:

Standard Specifications & Details Committee  
c/o Maricopa Association of Governments  
302 North First Avenue, Suite 300  
Phoenix, Arizona, 85003.

These suggestions will be reviewed by the committee and appropriate segments of the industry and cumulative annual revisions will be published the first of each year. A copy of this publication is available for review on the internet at the website listed below. Please follow the links to the publications page and look for *Uniform Standard Specifications for Public Works Construction* and/or *Uniform Standard Details for Public Works Construction*:

[www.mag.maricopa.gov](http://www.mag.maricopa.gov)

While in the interest of uniformity, it is hoped that all using agencies will adopt these standards with as few changes as possible, it is recognized that because of charter requirements and for other reasons, some agencies will find it necessary to modify or supplement certain requirements.

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Break down and compaction rolling shall be done by either steel-wheel or pneumatic-tire rollers. The Engineer may require a pneumatic-tire roller for one of the rolling operations. Rolling shall continue until the specific gravity of the compacted mixture is not less than 95 percent of the specific gravity of specimens composed of the same materials in similar proportions or composed of the same mixture compacted in the laboratory by the 75 blow method of AASHTO T-245 if the mix was designed by the Marshall method. If the mix was designed by The Asphalt Institute's SP-2 Gyratory method, rolling shall continue until the specific gravity of the compacted mixture is not less than 93 percent of the maximum theoretical specific gravity (ASTM D-2041) of specimens composed of the same materials in similar proportions or composed of the same mixture compacted in the laboratory.

Finish rolling shall be done by means of steel-wheeled roller or a vibratory steel-wheel roller operated in the static mode.

The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 25-foot straightedge when the straightedge is placed parallel to the centerline of the roadway. The straightedge shall be furnished by the contractor and shall be acceptable to the Engineer.

All streets shall be water tested for drainage in the presence of the Engineer or designated representative before final acceptance. Any areas not draining properly shall be corrected to the Engineer's satisfaction at the Contractor's expense. Water for this testing shall be provided and paid for by the Contractor.

When deviations in excess of the above tolerance are found, humps or depressions shall be corrected to meet the specified tolerance, or shall be cut out along neat straight lines and replaced with fresh hot mixture and thoroughly compacted to conform with and bond to the surrounding area. Materials and work necessary to correct such deviations shall be at no additional cost to the Contracting Agency.

**321.5.5 Preservative Seal:** An asphalt concrete preservative seal shall be used on all new asphalt concrete pavement and shall comply with Section 334. The Engineer will make a field determination and provide the actual application rate or delete the requirement. This seal is not required for pavement matching and surface replacement over pipe trenches, etc., unless specified in the special provisions.

### 321.6 CORRECTIVE REQUIREMENTS FOR DEFICIENCIES:

**321.6.1 Thickness:** The engineer or the permittee will test the density and thickness of the asphalt concrete after pavement construction is complete, using cores. The cores will be taken by the Engineer at random locations, at a minimum sampling rate of one core per 1,000 feet of lineal distance per paver pass width. For residential streets, a paver pass width will be considered to be a minimum of 12 feet. For residential streets, a minimum of one core will be taken between intersecting streets or portions thereof. When a deficiency of more than 1/4 inch is found, two additional cores will be taken not closer than 100 feet apart nor closer than 100 feet to the original core, and the average of these three cores will be used to determine the amount of the deficiency. Further cores may be taken by the Contractor if he so chooses, to determine the limits of the deficiency, and shall be at no additional cost to the Contracting Agency but shall not be used in determining the average thickness of the pavement. Thickness of the cores shall be determined by average caliper measurement. Where pavement thickness is deficient by 1/4 inch or less, it will be paid for at the contract price. The contractor shall repair all of the core holes using hot asphalt concrete from the project or a high quality asphalt based patching compound.

Where the pavement is deficient in thickness by more than 1/4 inch but not more than 1/2 inch, payment will be reduced per Table 321-1.

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| TABLE 321-1  |  |
|--|--|
| PAVEMENT THICKNESS PAYMENT REDUCTION (AC)<br>For Thickness Deficiency of More Than 1/4 inch and less than 1/2 inch |  |
| Specified Mat Thickness  | Reduction in Payment or Corrective Action  |
| A: When the agency is the contracting party:   |  |
| Less than 1.5 inches   | 50%  |
| 1.50 inches to 1.99 inches   | 33%  |
| 2.00 inches to 2.49 inches   | 25%  |
| 2.50 inches to 2.99 inches   | 20%  |
| 3.00 inches and over   | 17%  |
| B: When the agency is not the contracting party (work under permit, e.g. subdivision, utilities, etc.)             |  |
| For all thicknesses  | Corrective action shall be the same as that for pavement thickness deficiencies exceeding 1/2 inch as described below. |

When the deficiency of the pavement thickness exceeds 1/2 inch, the pavement shall be overlaid on the area affected, but in no case less than one City block or 660 feet, whichever is less in length, for the full width of pavement, with a new mat of material specified by the Engineer, equal in thickness to the deficiency but not less than 1/2 inch in any instance. This is to be done at no additional cost to the Contracting Agency. At locations where specific grades must be maintained, such as adjacent to curb and gutter or to accommodate drainage, the asphalt concrete surface may require milling prior to placement of the overlay.

When the pavement is deficient in thickness by more than 1/4 inch, all coring done to establish this premise shall be done by a laboratory that is independent of the contractor, and who is working under the direction of the Engineer. The cost of this work shall be born by the contractor by reduction of payments due under the contract.

**321.6.2 Density:** The Engineer or the permittee will test the density and thickness of the asphalt concrete after pavement construction is complete using cores. The cores will be taken in the same pattern as defined in Section 321.6.1, except that additional cores shall be taken if the density is less than the specified density. When the density represented by the average of three cores is deficient and the Contractor is unable to correct the deficiency, corrective action will be taken as prescribe in Table 321-1. For the purposes of this specification, the material represented by the set of three cores shall include all of the material placed in that paver pass for a length extending from half the distance to the previous core to half the distance to the next core.

At the discretion of the Engineer, for density deviations equal to or less than one percent, the average density of all of the cores taken from a given day's production may be used to represent all of the material placed that day.

The Agency's approval of the mix design does not guarantee the mix can be compacted to the specified limits. The Contractor shall work closely with the mix designer, compaction equipment manufacturers and the material supplier to assure the mix approved for use on the project can be compacted to the limits specified.

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| TABLE 321-2   |   |
|---|---|
| PAVEMENT DENSITY CORRECTION (ASPHALT CONCRETE)  |   |
| Deviation Below Specification   | Action  |
| A. When the Agency is the Contracting Party:  |   |
| Equal to or less than 1.0%  | \$1.00/ton of Asphalt Concrete penalty  |
| Greater than 1.0% and equal to or less than 2.0%  | \$2.00/ton of Asphalt Concrete penalty  |
| Greater than 2.0% and equal to or less than 3.0%  | \$3.00/ton of Asphalt Concrete penalty  |
| Greater than 3.0%   | See Note Below  |
| B. When the Agency is not the contracting party (work under permit, e.g.: subdivisions, utilities etc.) |   |
| Equal to or less than 2.0%  | See Agencies' policies, amendments, etc. pertaining to the action   |
| Greater than 2.0% and equal to or less than 3.0%  | Mill and inlay at a minimum depth of three times the nominal aggregate size using the same mix as specified for the project |
| Greater than 3.0%   | See Note Below  |

NOTE: The Contractor shall remove and replace the entire asphalt layer that is deficient. The dimensions of the repairs shall be the width of the paver or 12 feet, whichever is greater, and the length of one City block or 660 feet, whichever is less.

**321.6.3 Mineral Aggregate:** When the mineral aggregate gradation deviates from the requirements of this specification in an amount which, in the opinion of the Engineer, will affect the stability or durability of the mix, the Contractor shall, as directed by the Engineer, either: remove the asphalt concrete and replace it with material which meets the requirements of this specification, or place an additional mat of such thickness and gradation as required by the Engineer which will, in the opinion of the Engineer, correct the deficiency.

The above corrective work, due to deviations from the requirements for mineral aggregate, shall be done at no additional cost to the Contracting Agency.

**321.6.4 Acceptance Testing Requirements:** Tests used to determine acceptance under Section 321.6 will be performed by the Engineer or a laboratory employed by the Engineer. In either case, the laboratory shall be accredited by the AASHTO Materials Reference Laboratory (AMRL) or an equivalent certification Agency for AASHTO Method T 166.

If the Contractor has reason to question the validity of any of the acceptance test results, he may request that the Engineer consider verification tests for final acceptance. Any request for verification testing must describe the Contractor's reasons for questioning the validity of the original acceptance results and must clearly describe which set of acceptance tests are in question. The Engineer may either accept or reject the request for verification testing.

If the Engineer accepts the request for verification testing, he will engage an independent laboratory who is accredited by AMRL or equivalent. The independent laboratory shall be paid by the Engineer and shall perform a completely new set of acceptance tests (as required by 321.6) representing the area or set of tests in question. These tests shall include unit weight and thickness of cores, as well as Marshall or Maximum theoretical unit weight of the material obtained from the cores.

The verification tests shall be made on 6-inch diameter core specimens taken as near as it is practical to the acceptance test locations. For each sample, a minimum of three core specimens shall be taken, and the average values for unit weight and/or thickness shall be used.

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An adequate number of cores will be taken so their combined weight will be sufficient for a laboratory unit weight test in accordance with ASTM D2041 or AASHTO T 166, as appropriate for the specified mix design. The appropriate laboratory unit weight test shall be performed on the verification sample after re-heating and re-mixing the core specimens. The cores shall be prepared for testing by cleaning with a steel brush and by removing any extraneous lifts of differing materials. After removing extraneous materials, the entire core specimen will be used in the laboratory unit weight determination without removing aggregate particles that were cut by coring or trimming.

The number of samples taken will be in accordance with the Engineer's acceptance test frequency. The independent laboratory shall compile the test results and transmit them to both the Engineer and the Contractor. The independent laboratory shall include a letter signed by an Engineer registered in the State of Arizona, who is a specialist in asphalt concrete. The signed letter shall give an opinion that the material evaluated either does or does not comply with project specifications, and shall clearly describe any deficiencies.

If the difference in test results of the independent laboratory versus the original acceptance laboratory falls outside the multi-laboratory precision statements for the test methods being used, the contracting Agency will bear the cost of the verification testing. If the difference in tests results fall within the multi-laboratory precision statement, the cost for verification testing will be deducted from payments that were to be made to the Contractor. For test methods that do not have multi-laboratory precision statements, the cost for verification testing will be deducted from payments that were to be made to the contractor.

### 321.7 CURBS:

The curb shall be placed by an approved extrusion type machine. In the event the Contractor wishes to utilize a template which varies from the cross-section shown on the plans, such change must meet the approval of the Engineer. The asphalt mix used shall be a 9.5 mm mix. One percent by weight of the total mixture shall consist of a granulated synthetic resin stiffener, Lexite or equal, complying with the following characteristics:

|                               |           |                |
|-------------------------------|-----------|----------------|
| Softening Point (Ring & Ball) | ASTM D36  | 210°F. minimum |
| Acid Number                   | ASTM D465 | Less than 1.00 |
| Saponifiable matter           | ASTM D464 | Less than 1%   |
| Iodine Number                 | ASTM D29  | 175—185        |

### 321.8 MEASUREMENT:

Asphalt concrete pavement will be measured by the ton, computed to the nearest 0.10 of a ton or by the square yard, for the mixture actually used as allowed above, which shall include the required quantities of mineral aggregates, filler material, asphalt cement, and sand. Measurement shall include any tonnage used to construct intersections, roadways, streets, or other miscellaneous surfaces indicated on the plans or as directed by the Engineer.

Weighmaster's Certificates, in accordance with Section 109, will be provided regardless of method of measurement.

The bid price per ton or square yard for asphalt concrete shall include the cost of the asphalt cement in the percentages as specified in Section 710.

Asphalt concrete curbs will be measured by the linear foot, parallel to the base or foundation, unless otherwise specified.

Preservative seal for asphalt concrete pavement will be measured by the gallon diluted, unless otherwise indicated in the special provisions.

### 321.9 PAYMENT:

The asphalt concrete measured as provided above, will be paid for at the contract price per ton or square yard, which price shall be full compensation for the item complete, as herein described and specified.

Payment for tack coat will be by the ton diluted, based on the rate of application; as directed by the Engineer.

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The quantities of preservative seal, measured as provided above will be paid for at the contract bid price per gallon diluted or as specified, which price shall be full compensation for the item complete as herein described or as specified.

No payment will be made for any overrun in quantity of asphalt concrete in excess of 10 percent based on actual field measurement of area covered, design thickness, and a unit weight of 145 pounds per cubic foot. The calculations and payment for overrun will be by individual bid item. To compensate or adjust for a thickness deficiency in an underlying asphalt concrete course, the Engineer may authorize a quantity increase in excess of 10 percent for a subsequent asphalt concrete course. In such cases, the quantity in excess of 10 percent will be paid for at the lowest unit bid price.

Payment for the curbs will be at the contract unit price bid per linear foot, which price shall be full compensation for the curb complete in place, including all necessary labor, equipment and material.

Except as otherwise specified in the special provisions, no separate payment will be made for work necessary to construct miscellaneous items or surfaces of asphalt concrete.

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End of Section

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## **SECTION 345**

### **ADJUSTING FRAMES, COVERS, VALVE BOXES AND WATER METER BOXES**

#### **345.1 DESCRIPTION:**

The Contractor shall furnish all labor, materials, and equipment necessary to adjust all frames, covers and valve boxes as indicated on the plans or as designated by the Engineer. The frames shall be set to grades established by the Engineer, in a manner hereinafter specified.

The Contractor may elect to remove old frames, covers and valve boxes and to install new frames and/or boxes without any additional cost to the Contracting Agency, in accordance with standard detail drawings.

#### **345.2 ADJUSTING FRAMES:**

The Contractor shall loosen frames in such a manner that existing monuments, clean outs or valve boxes will not be disturbed or manholes damaged. Debris shall not be permitted to enter sanitary or storm sewer conduits. All loose material and debris shall be removed from the excavation and the interiors of structures prior to resetting frames.

Frames shall be set to the elevations and slopes established by the Engineer and shall be firmly blocked in place with masonry or metal supports. Spaces between the frame and the old seat shall be sealed on the inside to prevent any concrete from entering the hand hole or manhole. Class AA concrete shall be placed around and under the frames to provide a seal and properly seat the frame at the required elevation and slope. Concrete shall be struck off flush with the top of the existing pavement.

#### **345.3 ADJUSTING VALVE BOXES:**

Valve boxes shall be adjusted to the new elevations indicated on the plans, or as established by the Engineer.

Adjustable cast iron boxes shall, if possible, be brought to grade by adjustment of the upper movable section. Any excavated area shall be filled with Class AA concrete to the level of the existing pavement, or as directed by the Engineer.

Concrete pipe valve boxes in areas not subject to vehicular traffic shall be adjusted to grades by installing a suitable length of metal or concrete pipe, of the same inside diameter as the present valve box, and reinforcing the outside with a concrete collar extending from at least 2 inches below the joint up to and flush with the top of the valve box extension. This collar shall be of Class AA concrete. The dimension from the outside of the box to the outside of the collar shall not be less than 2 inches. This adjustment will be known as Type B.

In areas subject to vehicular traffic and where the existing valve box is a Type B, the adjustment to the new elevation shall be made using the old cover and installing a new 8 inches frame in accordance with the standard detail for installation of valve boxes in vehicular traffic areas. This adjustment shall be known as Type BA.

Adjustment of existing Type A valve boxes to the new elevations shall be as described in Subsection 345.2 above. This adjustment shall be known as Type A.

#### **345.4 ADJUSTING MANHOLE AND VALVE COVERS:**

Adjusting rings may be used to raise manhole covers in asphalt pavements when deemed acceptable by the Engineer. The amount of adjustment, thickness of seal or overlay, and cross slope will be considered when using adjusting rings. Each location where an adjusting ring is used must have a sufficient depth of asphalt to assure the proper installation and operation of the ring. The rings shall be made of a non-metallic, polypropylene or fiberglass material and installed per the manufacturer's specifications. The rings shall be approved by the Engineer.

#### **345.5 MEASUREMENT:**

The quantities measured will be the actual number of frames, covers and value boxes of each type, adjusted and accepted.

#### **345.6 PAYMENT:**

The quantities, as determined above will be paid for at the contract price per unit of measurement respectively, for each of the particular items listed in the proposal. The payment shall be compensation in full for all materials, labor, equipment and incidentals necessary to complete the work.

End of Section

## SECTION 350

### REMOVAL OF EXISTING IMPROVEMENTS

#### 350.1 DESCRIPTION:

This work shall consist of removal and disposal of various existing improvements, such as pavements, structures, pipes, curbs and gutters, and other items necessary for the accomplishment of the improvement.

#### 350.2 CONSTRUCTION METHODS:

The removal of existing improvements shall be conducted in such a manner as not to injure utilities or any portion of the improvement that is to remain in place. See Section 107.

Sidewalks shall be removed to a distance required to maintain a maximum slope for the replaced portion of sidewalk, for one inch per foot and all driveways shall be removed to a distance as required by standard details.

Existing concrete driveway curbs and gutters shall be removed to the right-of-way line and the new end of curb faced.

Portland cement concrete pavements, curbs and gutters and sidewalks designated on the plans for removal shall be saw-cut at match lines, in accordance with Section 601 and removed.

Asphalt concrete pavements designated on the plans for removal shall be cut in accordance with Section 336.

Removal of trees, stumps, roots, rubbish, and other objectionable materials in the right-of-way shall be done in accordance with Section 201.

Backfill and compaction of all excavated areas shall be compacted to the densities as prescribed in Section 601.

All surplus materials shall be immediately hauled from the jobsite and disposed of in accordance with Section 205.

#### 350.3 MISCELLANEOUS REMOVAL AND OTHER WORK:

This work shall include, but not be limited to the following, where called for on the plans:

- (A) Relocate existing fence and gate.
- (B) Remove and reset mail boxes.
- (C) Remove signs and bases in right-of-way.
- (D) Remove planter boxes, block walls, concrete walls, footings, headwalls, irrigation structures, and storm water inlets.
- (E) Install plugs for pipes and remove existing plugs as necessary for new construction.
- (F) Remove wooden and concrete bridges.
- (G) Remove median island slabs.
- (H) Remove pavements and aggregate base where called for outside the roadway prism.

#### 350.4 PAYMENT:

Payment for removals will be made at the unit bid prices bid in the applicable proposal pay items, which price shall be full compensation for the item complete, as described herein or on the plans.

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End of Section

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## SECTION 601

### TRENCH EXCAVATION, BACKFILLING AND COMPACTION

#### 601.1 DESCRIPTION:

The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with the excavation and backfilling of trenches for a single pipe installation in accordance with the plans and special provisions, except for the installation of high density polyethylene pipe (HDPE). See Section 603 for trench excavation, backfilling, and compaction of HDPE pipe.

Excavation for appurtenance structures, such as manholes, inlets, transition structures, junction structures, vaults, valve boxes, catch basins, etc., shall be deemed to be in the category of trench excavation.

#### 601.2 EXCAVATION:

**601.2.1 General:** The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the plans, and including excavation ordered by the Engineer of compacted backfill for the purpose of making density tests on any portion of the backfill.

All excavation shall be open cut unless otherwise shown on the plans or approved by the Engineer.

**601.2.2 Trench Widths:** Trenches for other than cast-in-place concrete pipe shall conform to the dimensions in Table 601-1, unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer.

| TABLE 601-1                      |  |   |
|----------------------------------|--|---|
| TRENCH WIDTHS                    |  |   |
| Size Of Pipe (I.D.)              | Maximum Width At Top Of<br>Pipe Greater Than<br>O.D. Of Barrel | Minimum Width<br>At Springline<br>Each Side of Pipe (1) |
| Less than 18 inches              | 16 inches  | 6 inches  |
| 18 inches to 24 inches inclusive | 19 inches  | 7 1/2 inches  |
| 27 inches to 39 inches inclusive | 22 inches  | 9 inches  |
| 42 inches to 60 inches inclusive | 1/2 O.D.   | 12 inches   |
| Over 60 inches                   | 36 inches  | 12 inches   |

- (1) When the specified compaction cannot be obtained in the haunch area and/or bedding zone, the Contractor shall make necessary changes in his methods and/or equipment to obtain the desired results. In some instances, the Minimum Width at Springline shall be adjusted wider to assist the Contractor in obtaining the compaction. The Engineer must be satisfied with the Contractor's compaction effort, concur with the change and approve the revised distance. There shall be no additional cost to the Agency for the extra trench width.

For multiple pipe installations in a single trench, the Engineer shall provide details on the plans or in the Special/Technical Provisions as to the layout, pipe configuration, distances between pipes and trench walls, the type of backfill, bedding and foundation materials, etc.

The width of the trench shall not be greater than the maximum indicated in Table 601-1, at and below the level of the top of the pipe. The width of the trench above that level may be made as wide as necessary for sheeting and bracing, and for proper installation of the work.

If the maximum trench width as specified in Table 601-1 is exceeded at the top of the pipe the Contractor shall provide, at no additional cost to the Contracting Agency, the necessary additional load bearing capacity by means of bedding, having a higher

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bedding factor than that specified, higher strength pipe, a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer.

**601.2.3 Trench Grade:** Alignment and elevation stakes shall be furnished the Contractor at set intervals and agreed upon offsets. On water main projects, elevation stakes will be furnished only when deemed necessary by the Engineer. In all cases where elevation stakes are furnished, the Engineer will also furnish the Contractor with cut sheets.

For all pipe 12 inches or greater in diameter, the Contractor shall excavate for and provide an initial granular bedding at least 4 inches thick or 1/12 the O.D. of the pipe whichever is greater. This bedding material shall be placed at a uniform density with minimum compaction and fine graded as specified below.

Bell or coupling holes shall be dug after the trench bottom has been graded. Such holes shall be of sufficient width to provide ample room for caulking, banding, or bolting. Holes shall be excavated only as necessary to permit accurate work in the making of the joints and to insure that the pipe will rest upon the prepared bottom of the trench, and not be supported by any portion of the joint.

Depressions for joints, other than bell-and-spigot, shall be made in accordance with the recommendations of the joint manufacturer for the particular joint used.

**601.2.4 Fine Grading:** Unless otherwise specified in the plans and/or special provisions, the bottom of the trench shall be accurately graded to provide uniform bearing and support for each section of the pipe at every point along its entire length, except for portions of the pipe where it is necessary to excavate for bells and for proper sealing of the pipe joints.

**601.2.5 Overexcavation:** Except at locations where excavation of rock from the bottom of the trench is required, care shall be taken not to excavate below the depth indicated.

Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM D-2922 and D-3017. When AASHTO T-99, method A or B, and T-191 are used for density determination, MAG Detail 190 will be used for rock correction.

Whenever rock is encountered in the trench bottom, it shall be overexcavated to a minimum depth of six inches below the O.D. of the pipe. This overexcavation shall be filled with granular material placed with the minimum possible compaction.

Whenever unsuitable soil incapable of supporting the pipe is encountered, the Contractor will notify the Engineer and a field determination will be made as to the depth of overexcavation and the granular fill required.

**601.2.6 Excavation for Manholes, Valves, Inlets, Catch Basins and Other Accessories:** The Contractor may excavate to place the concrete structure directly against the excavated surface, provided that the faces of the excavation are firm and unyielding and are at all points outside the structure lines shown on the plans. If the native material is such that it will not stand without sloughing or if precast structures are used, the Contractor shall overexcavate to place the structure and this overexcavation shall be backfilled with the same material required for the adjoining pipe line trench and compacted per Table 601-2.

Any unnecessary excavation below the elevation indicated for the foundation of any structure shall be replaced with the same class of concrete specified for the structure or with 1 1/2 sack controlled low strength material as specified in Section 728. When the replacement material is structural concrete, the material shall be placed at the same time as the structure. However, when using 1 1/2 sack controlled low strength material, placement of the material shall be per Section 604 which will require a time lag between the material and the structural concrete. The placement of the additional material shall be at no cost to the Agency.

**601.2.7 Pavement and Concrete Cutting and Removal:** Where trenches lie within the portland cement concrete section of streets, alleys, driveways, or sidewalks, etc., such concrete shall be sawcut to neat, vertical, true lines in such a manner that the adjoining surface will not be damaged. The minimum depth of cut shall be 1 1/2 inches or 1/4 of the thickness, whichever is greater.

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Asphalt pavement shall be clean-cut, with approved equipment and by approved methods in accordance with the requirements of Section 336.

No ripping or rooting will be permitted outside limits of cuts. Surfacing materials removed shall be hauled from the job site immediately, and will not be permitted in the backfill.

**601.2.8 Grading and Stockpiling:** All grading in the vicinity of trench excavation shall be controlled to prevent surface water from flowing into the trenches. Any water accumulated in the trenches shall be removed by pumping or by other approved methods.

During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance back from the edges of trenches, to avoid overloading and to prevent slides or cave-ins. Material unsuitable for backfilling, or excess material, shall be hauled from the job site and disposed of by the Contractor.

The Contractor shall, prior to final acceptance of the work, submit a letter to the Contracting Agency stating the location of each disposal site for all excess or unsuitable material and certify that he has obtained the property owner's permission for the disposal of all such materials.

Where the plans and/or special provisions provide for segregation of topsoil from underlying material for purposes of backfill, the material shall not be mixed.

**601.2.9 Shoring and Sheeting:** The Contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheathing, or shoring shall not be removed in one operation but shall be done in successive stages as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid for the pipe.

All shoring and sheeting deemed necessary to protect the excavation and to safeguard employees, shall be installed. See Section 107.

**601.2.10 Open Trench:** Except where otherwise noted in the special provisions, or approved in writing by the Engineer, the maximum length of open trench, where the construction is in any stage of completion (excavation, pipe laying or backfilling), shall not exceed 1320 feet in the aggregate at any one location.

Any excavated area shall be considered open trench until all ABC for pavement replacement has been placed and compacted. With the approval of the Engineer, pipe laying may be carried on at more than one separate location, the restrictions on open trench applying to each location. Trenches across streets shall be completely backfilled as soon as possible after pipe laying.

Substantial steel plates with adequate trench bracing shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular work hours. Safe and convenient passage for pedestrians shall be provided. The Engineer may designate a passage to be provided at any point he deems necessary. Access to hospitals, fire stations and fire hydrants must be maintained at all times.

### **601.3 PROTECTION OF EXISTING UTILITIES:**

**601.3.1 Utilities:** Unless otherwise shown on the plans or stated in the specifications, all utilities, both underground or overhead, shall be maintained in continuous service throughout the entire contract period. The Contractor shall be responsible and liable for any damages to or interruption of service caused by the construction.

If the Contractor desires to simplify his operation by temporarily or permanently relocating or shutting down any utility or appurtenance, he shall make the necessary arrangements and agreements with the owner and shall be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. All property shall be reconstructed in its original or new location as soon as possible and to a condition at least as good as its previous condition. This cycle of relocation or shutdown and reconstruction shall be subject to inspection and approval by both the Engineer and the owner of the utility.

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The Contractor shall be entirely responsible for safeguarding and maintaining all conflicting utilities that are shown on the plans (Sections 107 and 105 apply). This includes overhead wires and cables and their supporting poles whether they are inside or outside of the open trench. If, in the course of work, a conflicting utility line that was not shown on the plans is discovered, the Contracting Agency will either negotiate with the owner for relocation, relocate the utility, change the alignment and grade of the trench or as a last resort, declare the conflict as “extra work” to be accomplished by the Contractor in accordance with Section 104.

**601.3.2 Irrigation Ditches, Pipes and Structures:** The Contractor shall contact the owners of all irrigation facilities, and make arrangements for necessary construction clearances and/or dry-up periods.

All irrigation ditches, dikes, headgates, pipe, valves, checks, etc., damaged or removed by the Contractor, shall be restored to their original condition or better, by the Contractor at no additional cost to the Contracting Agency.

**601.3.3 Building, Foundations and Structures:** Where trenches are located adjacent to building, foundations, and structures, the Contractor shall take all necessary precaution against damage to them. The Contractor shall be liable for any damage caused by the construction.

Except where authorized in the special provisions or in writing by the Engineer, water settling of backfill material in trenches adjacent to structures will not be permitted.

**601.3.4 Permanent Pipe Supports:** Permanent pipe supports for the various types and sizes of sewer, water and utility lines shall conform to the Standard Details or the details shown on the plans. Such pipe supports shall be erected at the locations shown on the plans and/or at any other locations as necessary as determined by the Engineer.

**601.3.5 Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines:** These underground facilities shall be adequately supported by the Contractor. Support for plastic pipes shall be continuous along the bottom of the pipe. Support for metal pipe and electrical conduit may be continuous or nylon webbing may be used for suspension at no greater than ten-foot intervals.

The Contractor shall avoid damaging the plastic pipe, pipeways or conduits during trench backfilling and during foundation and bedding placement.

There will be no measurement or payment for this work. The Contractor will include all associated costs in the unit bid price for the conduit installation.

### **601.4 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION:**

**601.4.1 Foundation:** The material upon which the conduit or structure is to be placed shall be accurately finished to the grade or dimensions shown on the plans or as directed by the Engineer. The bottom portion of the trench shall be brought to grade so that the conduit or structure will be continuously in contact with the material on which it is being placed. If rocky or unsuitable soil is encountered, Subsection 601.2.5 applies.

**601.4.2 Bedding:** Bedding shall consist of granular material containing no pieces larger than 1 1/2 inches and free of broken concrete, broken pavement, wood or other deleterious material. Open graded rock will not be used without the written approval of the Engineer.

Where water consolidation is used, bedding for conduits, 24 inches or less in I.D., may be placed in one lift. For larger conduits the first lift shall not exceed the springline of the pipe.

Where mechanical compaction is used, the moisture content shall be such that the specified compaction can be obtained. The first lift shall be 8 inches or two-thirds of the distance to the springline whichever is greater. Succeeding lifts shall not exceed 2 feet loose and extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment.

**601.4.3 Backfill:** Backfill shall be sound earthen material free from broken concrete, broken pavement, wood or other deleterious material. Unless otherwise specified, this may be native material with no piece larger than 4 inches, select material or aggregate base course. Backfill under street pavement shall be constructed per Detail 200 with the type of replacement noted on the plans

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or in the special provisions. Unless otherwise noted, backfill under single curb, curb and gutter, sidewalk, driveways, valley gutters, etc. shall be the same as the adjacent street pavement.

Where water consolidation is used, backfill will be placed in lifts as required in the following table prior to settlement.

| Trench Width | Backfill Lifts   |
|--------------|------------------|
| 180to 240    | Not to exceed 4N |
| 250to 360    | Not to exceed 6N |
| Over 360     | Not to exceed 8N |

The above backfill lift limitations are not applicable when water saturation is done by the jetting method.

Where mechanical compaction is used, backfill shall be placed in lifts the height of which shall not exceed that which can be effectively compacted depending on the type of material, type of equipment and methods used, and under no circumstances shall exceed 4 feet.

Backfill, around utilities that are exposed during trench excavation, shall be placed in accordance with the bedding methods.

**601.4.4 Compaction Densities:** Unless otherwise provided in the plans and/or special provisions, the trench backfill shall be thoroughly compacted to not less than the densities in Table 601-2 when tested and determined by AASHTO T-99 and T-191 or ASTM D-2922 and D-3017. When AASHTO T-99, method A or B, and T-191 are used for density determination, MAG Detail 190 will be used for rock correction.

The density required will depend on the Type shown on the plans and/or called for in the special provisions. Density required for each type shall comply to Table 601-2.

| TABLE 601-2                         |   |   |  |   |
|-------------------------------------|---|---|--|---|
| MINIMUM TRENCH COMPACTION DENSITIES |   |   |  |   |
| Backfill Type                       | Location  | From Surface To 2 feet Below Surface      | From 2 feet Below Surface To 1foot Above Top of Pipe | From 1 foot Above Top of Pipe to Bottom of Trench |
| <b>I</b>                            | Under any existing or proposed pavement, curb, gutter, sidewalk, or such construction included in the contract, or when any part of the trench excavation is within 2Nof the above. | 100% for granular<br>95% for non-granular | 90%  | 90%   |
| <b>II</b>                           | On any utility easement street, road or alley right-of-way outside limits of (I).   | 85%                                       | 85%  | 90%   |
| <b>III</b>                          | Around any structures or exposed  | 95%                                       | in all cases   |   |

Note: The type required will generally be shown on the plans and the plans will govern. Where no type is shown on the plans the type shall comply with Table 601-2.

A consideration in determining the backfill Types as shown on the plans, is based on the trench widths as shown in the Contract Documents. If these trench widths increase beyond those widths referred to above and fall within the 2-foot limit of paved surfaces and other improvements due to construction exigencies, the backfill designation for that portion within the 2-foot limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

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**601.4.5 Compaction Methods:** Water consolidation by jetting shall be accomplished with a 1 1/2 inches pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished traversely across the trench at intervals of not more than 6 feet with the jetting locations on one side of the trench offset to the jetting locations on the other side of the trench. The entire lift shall be leveled and completely saturated working from the top to the bottom.

Jetting shall be used as the consolidation method for all conduit bedding. The Contractor shall be entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the Contracting Agency. However, for conduit larger than 24 inches I.D. the first lift shall not exceed the springline of the conduit.

Flooding is not acceptable as a water consolidation method unless authorized in the specification or by a written change order. It will consist of the inundation of the entire lift with water and then puddled with poles or bars to insure saturation of the entire lift.

Where jetting or flooding is utilized and the surrounding material is such that it does not permit proper drainage, the Contractor shall provide, at his expense a sump and a pump at the downstream end to remove the accumulated water.

The use of water consolidation does not relieve the Contractor from the responsibility to make his own determination that such methods will not result in damage to existing improvements. The Contractor shall be responsible for any damage incurred.

Where water consolidation is not permitted or does not result in adequate compaction, the backfill material shall be compacted with hand and/or mechanical work methods using equipment such as rollers, pneumatic tamps, and hydro-hammers or other approved devices which secure uniform and required density without injury to the pipe or related structures.

Where Type I backfill is required, water consolidation will not be permitted for non-granular material, except in the following situation. In a new development prior to paving and prior to opening the area to public traffic, water consolidation, will be permitted for non-granular material at the Contractor's discretion and responsibility.

**601.4.6 Specifications for Granular Material:** For purposes of this specification, granular material shall mean material for which the sum of the plasticity index and the percent of the material passing a No. 200 sieve shall not exceed 23. The plasticity index shall be tested in accordance with AASHTO T-146 Method A (Wet Preparation), T-89 and T-90.

**601.4.7 Rights-Of-Way Belonging to Others:** Backfill and compaction for irrigation lines of the Salt River Valley Water Users' Association and Roosevelt Irrigation Districts and for trenches in State of Arizona and Maricopa County rights-of-way outside the limits of the Contracting Agency shall be accomplished in accordance with their permit and/or specifications.

**601.4.8 Test Holes:** Boring logs shown on the plans do not constitute a part of the contract and are included for the Contractor's convenience only. It is not intended to imply that the character of the material is the same as that shown on the logs at any point other than that where the boring was made. The Contractor shall satisfy himself regarding the character and amount of rock, gravel, sand, silt, clay and water to be encountered in the work to be performed.

**601.4.9 Foundation and Bedding for Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines:** Foundation and bedding for these underground facilities shall be native material or sand which conforms to the grading requirement of ASTM C-33 for fine aggregate. When backfill material consists of aggregate base course, crushed stone, or other material containing stones, only sand will be used for foundation, and bedding. The foundation depth shall be six inches and bedding depth shall be one foot above the top of the facility. Compaction will be in accordance with Section 601.

### **601.5 CONTRACTOR CERTIFICATION OF INSTALLATION PROCEDURES:**

When requested in the Special Provisions or by the Engineer prior to installation, the Contractor shall furnish to the Contracting Agency an affidavit (certification) from the pipe manufacturer (or his designee) stating that the Contractor is familiar with the manufacturer's suggested installation methods and procedures and the installation complies with those procedures and is consistent with MAG requirements.

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Also, when required in the Special/Technical Provisions or requested by the Engineer, the pipe manufacturer or his designee will review the Contractor's methods and procedures for pipe installation in the field. The Contractor will make any adjustments in the installation as recommended by the manufacturer or his representative. If necessary, the Contractor may be required to reinstall or provide corrections to pipe installed prior to the field review at no cost to the Agency. Once the manufacturer or his representative has reviewed the Contractor's installation methods and the Contractor has adjusted his installation methods as recommended by the same, the manufacturer or his representative shall furnish to the Contracting Agency an affidavit (certification) that the Contractor's installation methods and procedures, at the time of the review, complied with the manufacturer's installation practices. The affidavit must provide the name of the manufacturer's representative witnessing the pipe installation.

### **601.6 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:**

**601.6.1 Grading:** The Contractor shall do such grading in the area adjacent to backfilled trenches and structures as may be necessary to leave the area in a neat and satisfactory condition approved by the Engineer.

**601.6.2 Restoring Surface:** All streets, alleys, driveways, sidewalks, curbs, or other surfaces, in which the surface is broken into or damaged by the installation of the new work, shall be resurfaced in kind or as specified to the satisfaction of the Engineer in accordance with Section 336.

**601.6.3 Cleanup:** The job site shall be left in a neat and acceptable condition. Excess soil, concrete, etc., shall be removed from the premises.

**601.6.4 Temporary Pavement:** The Contractor shall install temporary asphalt pavement or the first course of permanent pavement replacement in accordance with Section 336 immediately following backfilling and compaction of trenches that have been cut through existing pavement. Except as otherwise provided in Section 336, this preliminary pavement shall be maintained in a safe and reasonably smooth condition until required backfill compaction is obtained and final pavement replacement is ordered by the Engineer. Temporary paving removed shall be hauled from the job site and disposed of by the Contractor at no additional cost to the Contracting Agency.

### **601.7 PAYMENT:**

No pay item will be included in the proposal, nor direct payment made for trench excavation, backfilling, compaction, or placement of temporary pavement. The cost of these features of the work shall be included in the unit price bid per linear foot for furnishing and laying pipe.

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End of Section

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## SECTION 603

### INSTALLATION FOR HIGH DENSITY POLYETHYLENE PIPE

#### 603.1 DESCRIPTION:

The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials and performing all operations in connection with a large-diameter High Density Polyethylene (HDPE) pipe installation in accordance with the plans, specifications and special provisions.

For installation procedures of HDPE for sewer line construction, see Section 615.

For installation procedures of HDPE for storm drain construction, see Section 618.

HDPE pipe and fittings shall conform to Section 738.

This section covers large-diameter HDPE pipeline installations of gravity and low-pressure storm drain and sanitary sewer construction.

For the purpose of this specification, low-pressure is defined as the test pressures of 3.5 psi of air or 4 feet of water as specified in Section 615.10.

For the purpose of this specification, large-diameter HDPE pipe shall include 8 inches through 120 inches nominal diameter.

#### 603.2 EXCAVATION:

Excavation shall comply with Subsection 601.2. Trench widths shall comply with Subsection 601.2.2, Table 601-1 and Note (1) for HDPE pipe, meeting AASHTO M-252, and AASHTO M-294. Trench widths for profile HDPE pipe, meeting ASTM F-894, will be designed by the Engineer and included on the plans or in the special provisions.

#### 603.3 PROTECTION OF EXISTING UTILITIES:

Protection of existing utilities shall comply with Subsection 601.3.

#### 603.4 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION:

**603.4.1 Foundation:** Foundation shall comply with Subsection 601.4.1.

**603.4.2 Bedding:** Coarse aggregate shall be used for bedding of large-diameter profile HDPE pipe. Coarse aggregate shall be in accordance with Subsection 603.4.6, for size, type, and gradation. For corrugated HDPE pipe as defined under Section 738, bedding shall meet the requirements of subsection 601.4.2 and Table 601-2 with the compaction requirements stipulated below.

Bedding material shall be carefully deposited in 8 inches or less loose lifts, thoroughly and carefully compacted around the pipe, equally around both sides of the pipe, with approved vibratory compactors or other tools or equipment when applicable, or by shovel slicing as approved by the Engineer. This shall be repeated until enough material is placed and compacted to provide a minimum of one (1) foot cover over the top of profile HDPE pipe, or to the top of corrugated HDPE pipe. Compaction densities, as well as further compaction requirements shall be as stipulated in Table 601-2, unless shown otherwise on the plans.

**603.4.3 Backfilling:** Backfilling shall comply with Subsection 601.4.3.

**603.4.4 Compaction Densities:** Compaction densities shall comply with Subsection 601.4.4.

**603.4.5 Compaction Methods:** For large-diameter HDPE pipe installations where the backfill and bedding material is coarse aggregate, mechanical compaction shall be the only method for consolidating backfill and bedding. Water consolidation shall not be used as a method of compaction for coarse aggregate whether used as a foundation, bedding or backfill material.

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For large-diameter pipe installations where the backfill material is other than coarse aggregate, consolidation shall be by mechanical means. Water consolidation may be used as a compaction method for the backfill material only when prior written approval to do so is provided by the Engineer.

**603.4.6 Specifications for Material:** Coarse aggregate shall consist of crushed rock as defined in Section 701 with 100 percent of the specified size of aggregate having one fractured face, and having the gradation complying with ASTM D-448, Table 1, Size Numbers 6, 67, 68, 7, 78, or 8 as recommended by the Engineer. The gradation size number to be furnished shall be shown on the plans or in the project specifications.

**603.4.7 Rights-of-Way Belonging to Others:** Rights-of-way belonging to others shall comply with Subsection 601.4.7.

**603.4.8 Test Holes:** Test holes shall comply with Subsection 601.4.8.

**603.4.9 Foundation and Bedding for Electronic, Telephonic, Telegraphic, Electric, Oil and Gas Lines:** Foundation and bedding for electronic, telephonic, telegraphic, electric, oil and gas lines shall comply with Subsection 601.4.9.

### 603.5 PREPARING AND INSTALLING HDPE PIPE:

**603.5.1 Storage and Handling:** Pipe shall be stored and handled in such a way to minimize out-of-roundness. Pipe shall be stored in shaded areas to minimize adverse effects of thermal, and ultraviolet exposure.

Pipe that is out-of-round in excess of 3% of the nominal pipe diameter as specified in Section 738, shall not be installed and shall be removed if installed.

**603.5.2 Strutting:** Strutting of Profile HDPE pipe per Section 738 will be required when the diameter is 42 inches or larger. For Profile HDPE pipe with diameters smaller than 42 inches, strutting may be required at the discretion of the Engineer. Strutting of Corrugated HDPE pipe per Section 738 is not required.

Strutting consists of placing wood struts, whose length is typically 3% longer than the nominal pipe diameter, inside the pipe. A minimum of three (3) sets of struts are placed in each pipe length, oriented vertically, spaced equally throughout the length of pipe and set so as not to interfere with the jointing of the pipe. The struts shall be kept in place until the bedding material is placed and compacted around the pipe. The struts must be removed before any backfill or bedding is placed above the pipe. The procedure of strutting the pipe shall not damage the pipe in any way. If the pipe is out of round, the struts will be placed in the long direction of the out-of-round. If the strut cannot be held in place by the pipe, the pipe will be removed from the job site per Subsection 738.9.

**603.5.3 Orienting:** If the pipe is out-of-round, the pipe should be oriented so that the long axis is placed vertically when installed in the trench. When struts are used, the struts shall be oriented vertically when pipe is installed in the trench.

**603.5.4 Installing Pipe:** HDPE pipe and fittings shall be installed in accordance with ASTM D-2321 or manufacturer's recommendation. HDPE pipe shall be handled so as not to damage the pipe. Hoisting shall be accomplished with cloth belt slings or ropes. The pipe shall be protected by wood blocking when jointing is accomplished by pipe jacking, back hoe bucket, come-along, or cable pipe puller.

### 603.6 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

Pavement replacement and surface restoration shall comply with Subsection 601.5.

### 603.7 PAYMENT:

No pay item will be included in the proposal, nor direct payment made for trench excavation, backfilling, compaction, or placement of temporary pavement. The cost of these features of work shall be included in the unit price per bid per linear foot for furnishing and laying pipe.

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End of Section

## SECTION 710

### ASPHALT CONCRETE

#### 710.1 GENERAL:

Asphalt concrete shall be a mixture of asphalt cement and mineral aggregates. Mineral admixture, mineral filler and anti-stripping agent shall be included in the mixture when required by the mix design or by the Engineer. All materials shall be proportioned by weight, volume or a combination in a central mix plant in the proportions required by the mix design to provide a homogeneous and workable mass.

The asphalt concrete mixes shall be of the types shown in Table 710-1.

| TABLE 710-1            |                        |  |  |
|------------------------|------------------------|--|--|
| ASPHALT CONCRETE MIXES |                        |  |  |
| Designation<br>(mm)    | Application            | Design Target Lift Thickness<br>For Mixes Above The<br>Restricted Zone, mm (in.) | Design Target Lift Thickness<br>For Mixes Below The<br>Restricted Zone, mm (in.) |
| 9.5                    | Surface Course         | 25.0 (1.0 inches)  | 37.5 (1.5 inches)  |
| 12.5                   | Surface Course         | 37.5 (1.5 inches)  | 50.0 (2.0 inches)  |
| 19.0                   | Base or Surface Course | 62.5 (2.5 inches)  | 75.0* (3.0 inches)   |
| 25.0                   | Base Course            | 75.0 (3.0 inches)  | 100.0 (4.0 inches)   |

\*19mm mixes designed below the restricted zone are not for use as a surface course.

The designation is the nominal maximum aggregate size of the mix. The nominal maximum aggregate size is defined as the next largest sieve size above the first standard sieve to retain more than 10 percent of the mineral aggregate. The standard sieve sizes are 9.5 mm, 12.5 mm, 19 mm and 25 mm.

Each mix shall be designed for low, or high traffic conditions. Low traffic conditions are conditions where the asphalt mix will be subject to low volume and low weight vehicle usage. Examples of this condition are residential streets, most parking lots and residential minor collector streets. High traffic conditions are conditions where the asphalt mix will be subject to high volume and/or heavy weight vehicle usage as found on major collector, arterial and commercial streets. Street classifications (i.e. minor collector and major collector shall be determined by the specifying agency.

#### 710.2 MATERIAL:

**710.2.1 Asphalt Cement:** The asphalt cement specified in this section has been developed for use in desert climate conditions. Should it be utilized in other climates, consideration should be given to adjustments in the asphalt selection. The asphalt cement shall be a performance grade asphalt conforming to the requirements of Section 711 for PG 70-10, unless otherwise specified in the plans or special provisions.

**710.2.2 Aggregate:** Coarse and fine aggregates shall conform to the applicable requirements of Section 701, except as modified herein.

Coarse aggregate is material retained above the 2.36 mm sieve and fine aggregate is material passing the 2.36 mm sieve.

Blend sand (naturally occurring or crushed fines) shall be clean, hard and sound material which will readily accept asphalt coating. The blend sand grading shall be such that, when it is mixed with the other mineral aggregates, the combined product shall meet the grading requirements of the designated mix, as specified in tables 710-2, 710-3 and 710-4.

The natural sand shall not exceed 15 percent by weight of the total aggregate for all mixes.

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**710.2.2.1 Aggregate Structure:** For mix design only, the combined aggregates, including the mineral admixture, mineral filler and anti-strip agent, shall meet the gradation requirement in Table 710-2.

| TABLE 710-2  |                  |            |           |           |          |
|--|------------------|------------|-----------|-----------|----------|
| GRADATION REQUIREMENTS - PERCENT BY WEIGHT PASSING |                  |            |           |           |          |
| Sieve Size (mm)                                    | Designation (mm) |            |           |           |          |
|  | 9.5              | 12.5       | 19        | 25        | 37.5     |
| 50.0   | --               | --         | --        | --        | 100      |
| 37.5   | --               | --         | --        | 100       | 90 - 100 |
| 25.0   | --               | --         | 100       | 90 - 100  | < 90     |
| 19.0   | --               | 100        | 90 - 100  | < 90      | --       |
| 12.5   | 100              | 90 - 100   | 68-88     | --        | --       |
| 9.5  | 90 - 100         | < 90       | 56-80     | --        | --       |
| 4.75   | < 90             | --         | --        | --        | --       |
| 2.36   | 32 - 67          | 28 - 58    | 23 - 49   | 19 - 45   | 15 - 41  |
| 0.075  | 2.0 - 10.0       | 2.0 - 10.0 | 2.0 - 8.0 | 1.0 - 7.0 | 0 - 6.0  |

The limits of a restricted zone shall be defined as the sieve gradations in Table 710-3.

| TABLE 710-3   |                  |             |             |             |             |
|---|------------------|-------------|-------------|-------------|-------------|
| RESTRICTED ZONE BOUNDARY<br>Percent Passing (Minimum - Maximum) |                  |             |             |             |             |
| Sieve Size (mm)   | Designation (mm) |             |             |             |             |
|   | 9.5              | 12.5        | 19          | 25          | 37.5        |
| 4.75  | --               | --          | --          | 39.5 - 39.5 | 34.7 - 34.7 |
| 2.36  | 47.2 - 47.2      | 39.1 - 39.1 | 34.6 - 34.6 | 26.8 - 30.8 | 23.3 - 27.3 |
| 1.18  | 31.6 - 37.6      | 25.6 - 31.6 | 22.3 - 28.3 | 18.1 - 24.1 | 15.5 - 21.5 |
| 0.60  | 23.5 - 27.5      | 19.1 - 23.1 | 16.7 - 20.7 | 13.6 - 17.6 | 11.7 - 15.7 |
| 0.30  | 18.7 - 18.7      | 15.5 - 15.5 | 13.7 - 13.7 | 11.4 - 11.4 | 10.0 - 10.0 |

When plotted on a Federal Highway Administration 0.45 Power Gradation Chart, the aggregate grading shall miss the restricted zone as shown in Table 710-3. Any gradation that passes through the restricted zone will be considered unacceptable. When the asphalt pavement will be subject to high traffic conditions, the gradation curve shall fall below the restricted zone.

When the asphalt pavement will be subject to high traffic conditions, the gradation curve may fall on either side of the restricted zone.

**710.2.2.2 Aggregate Characteristics:** The coarse and fine aggregates shall comply with the requirements of Table 710-4.

**710.2.3 Mineral Filler, Mineral Admixture and Anti-Stripping Agent:** Mineral filler shall conform to the requirements of AASHTO M-17. The amount of mineral filler shall be determined by the mix design.

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Mineral admixture or anti-stripping agent shall be dry hydrated lime, conforming to the requirements of ASTM C-207 Type N, or Portland cement conforming to Section 725. The amount of hydrated lime or Portland cement used shall be determined by the mix design.

When liquid anti-stripping agents are used, the agent shall conform to the requirements of AASHTO designation R 15-89. The agent shall be added in accordance with the manufacturer's recommended dosage rate.

Other mineral filler, mineral admixture, or anti-stripping agents, shall be approved by the Engineer prior to start of the mix design

| TABLE 710-4  |                    |                                    |
|--|--------------------|------------------------------------|
| COARSE/FINE AGGREGATE REQUIREMENTS                                   |                    |                                    |
| Characteristics  | Low Volume Traffic | High Volume Traffic                |
| Fractured Faces %<br>(Coarse aggregate only)<br>AZ test method 212D) | 75.0, 1 or more    | 85.0, 1 or more<br>80.0, 2 or more |
| Uncompacted Voids % Min.<br>(AASHTO T 304, Method A)                 | 42.0               | 45.0                               |
| Flat & Elongated Pieces % Max.                                       | 10.0               | 10.0                               |
| Sand Equivalent % Min.<br>(AASHTO T 176)                             | 40.0               | 50.0                               |
| Plasticity Index<br>(AASHTO T 90)                                    | Non-plastic        | Non-plastic                        |

### 710.3 MIX DESIGN REQUIREMENTS:

**710.3.1 General:** Unless authorized by the Engineer, no work shall be started on the project until the Contractor or his supplier has submitted an asphalt mix design acceptable to the Engineer. The mix design shall be prepared by a laboratory that is accredited through the AASHTO Accreditation Program in Hot Mix Asphalt Aggregates and Hot Mix Asphalt or The National Bureau of Standards in the National Voluntary Laboratory Accreditation Program (NVLAP) for Construction Services (Asphalt). The laboratory shall be under the direct supervision of a Civil Engineer, registered by the State of Arizona, with a minimum of five years experience in the development of asphalt concrete mix designs. A copy of the certification shall be required with each mix design submittal. The date of the design shall not be older than one year from the date of submittal, unless supportive documentation is provided and approved by the Engineer.

The mix design report shall include the following elements.

- (1) A description of all products that are incorporated in the asphalt concrete along with a statement disclosing the sources of all products, including mineral admixtures, asphalt modifiers, anti-stripping agents and their method of introduction.
- (2) The mix plant location, a copy of the certification of Hot Mix Asphalt Production Facilities by Arizona Rock Products Association and a copy of all certifications for weighing and metering devices within the plant.
- (3) The results of testing performed on all aggregates to assure compliance with Section 701 and 710.
- (4) The results of all laboratory tests associated with the mix design development, a plot of the gradation on the Federal Highway Administration's 0.45 Power Gradation Chart, plots of all compaction curves and the results of the moisture damage testing (Section 710.3.6).
- (5) A specific recommendation for design asphalt content and any limiting conditions that may be associated with the use of the design, such as minimum percentages of crushed or washed fine aggregate.

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- (6) Mixing and compaction temperatures.
- (7) The supplier's product code, the laboratory Engineer's seal (signed and dated), and the date the design was performed.

The mix design shall be submitted to the Agency by the Contractor for which it was developed. This submittal shall include a certification, signed by the Officer of the Contractor or his supplier stating that the materials submitted for the mix design are representative of those that will be utilized for the production of the asphalt concrete represented by the mix design. Once the mix design has been approved by the agency and the mixing plant selected, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer. Any changes in the plant operation, the producers pit, the asphalt cement, including modifiers, or any other item that will cause an adjustment in the mix, shall be justification for a new mix design to be submitted.

**710.3.2 Mix Design Criteria:** The mix design shall be performed by one of two methods, Marshall Mix Design or Superpave™ Mix Design. The method shall be specified on the plans, special provisions, or by the Engineer. A minimum of 4 points will be used to establish the mix design results.

**710.3.2.1 Marshall Mix Design :** The Marshall Mix Design shall be performed in accordance with the requirements of The Asphalt Institute's Manual, MS-2 "Mix Design Methods for Asphalt Concrete". The mix shall utilize the compactive effort described in AASHTO T-245, "Standard Method of Test for the Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus." The mix shall comply with the criteria in Table 710-5.

| TABLE 710-5                                  |               |               |
|--|---------------|---------------|
| MARSHALL MIX DESIGN CRITERIA                 |               |               |
| Characteristics                              | Low Traffic   | High Traffic  |
| Compactive Effort<br>(Each Side of Specimen) | 50 blows      | 75 blows      |
| Marshall Stability, N                        | 3,500 Minimum | 8,000 Minimum |
| Marshall Flow, 0.25 mm                       | 8 - 16        | 8 - 16        |
| Effective Air Voids, %                       | 4.0±0.2       | 4.0±0.2       |
| Voids in Mineral Aggregate, %                | Table 710-8   | Table 710-8   |
| Voids Filled with Asphalt, %                 | 70-80         | 65-75         |
| Calculated Film Thickness                    | 10-14 Microns | 8-14 Microns  |

The calculated film thickness in Table 710-5 and 710-6 should be determined using the following formula:

$$T_f = \frac{(4876.8) (P_{be})}{(SA) (P_s) (G_b)}$$

Where,

$T_f$  = Asphalt Film thickness, Microns

$P_{be}$  = Effective Asphalt Content, percent by total weight of mixture

SA = Surface Area of Aggregate (square feet per pound)

$P_s$  = Aggregate Content, Percent by Total weight of Mixture

$G_b$  = Specific Gravity of Asphalt Cement

Surface Area (SA) calculations should follow procedures outlined in Chapter 6 of the Asphalt Institute Manual Series No. 2 (MS-2), Sixth Edition.

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**710.3.2.2 Superpave™ Mix Design:** The Superpave™ Mix Design shall be performed in accordance with the requirements of The Asphalt Institute's "Superpave™ Volumetric Mix Design Manual, SP-2." The design shall utilize the Superpave™, gyratory compactor described in AASHTO TP-4, "Preparation of Compacted Specimens of Modified and Unmodified Hot Mix Asphalt by Means of the SHRP Gyratory Compactor" and AASHTO PP-2, "Short and Long-term Aging Bituminous Mixes." The mix shall comply with the criteria in Table 710-6.

| TABLE 710-6                    |               |              |          |
|--------------------------------|---------------|--------------|----------|
| SUPERPAVE™ MIX DESIGN CRITERIA |               |              |          |
|                                | Low Traffic   | High Traffic | Criteria |
| Gyrations                      |               |              |          |
| Nini                           | 7             | 8            | < 89*    |
| Ndes                           | 75            | 100          | 96±0.2*  |
| Nmax                           | 115           | 160          | < 98*    |
| % Voids                        | 4.0 ±0.2      | 4.0 ±0.2     | --       |
| % Voids in Mineral Aggregate   | Table 710-8   | Table 710-8  | --       |
| % Voids Filled                 | 70-80         | 65-75        | --       |
| Calculated Film Thickness      | 10-14 Microns | 8-14 Microns |          |

\* These criteria are expressed as a percentage of the maximum theoretical specific gravity.

**710.3.3 Asphalt Cement Content:** The design asphalt cement content shall be expressed as a percentage of the total mix weight and shall be stated in the mix design to the nearest 0.1 percent. Table 710-7 is the allowable range of design asphalt cement contents for each mix designation. If the mix design places the design asphalt content outside of these ranges, the Contractor or his supplier will review the test data with the Engineer to determine if the design is acceptable. The Engineer shall approve the variance prior to the completion of the mix design.

| TABLE 710-7              |   |   |
|--------------------------|---|---|
| ASPHALT CONTENT (%)      |   |   |
| Mix/<br>Designation (mm) | For Gradations Above<br>the Restricted Zone | For Gradations Below<br>the Restricted Zone |
| 9.5 and 12.5             | 5.5 to 6.5                                  | 5.0 to 6.0                                  |
| 19.0                     | 5.0 to 6.0                                  | 4.5 to 5.5                                  |
| 25.0 and 37.5            | 4.0 to 5.0                                  | 3.5 to 5.0                                  |

**710.3.4 Voids in Mineral Aggregate:** The voids in the mineral aggregate shall comply with the criteria in Table 710-8, with respect to the nominal maximum aggregate size.

| TABLE 710-8                               |                      |                          |
|---|----------------------|--------------------------|
| VOIDS IN MINERAL AGGREGATE                |                      |                          |
| Nominal Maximum Size/<br>Designation (mm) | Maximum Size<br>(mm) | Minimum VMA<br>(percent) |
| 9.5                                       | 12.5                 | 15.0                     |
| 12.5                                      | 19.0                 | 14.0                     |
| 19.0                                      | 25.0                 | 13.0                     |
| 25.0                                      | 37.5                 | 12.0                     |
| 37.5                                      | 50.0                 | 11.0                     |

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**710.3.5 Dust Proportion:** The dust proportion is defined as the ratio of the percent finer than the 0.075 mm sieve, including mineral filler, mineral admixture, and anti-stripping agent, to the effective binder content ( $P_{0.075}/P_{be}$ ). The dust proportion shall be between 0.60 and 1.2 for aggregate gradations that fall below the restricted zone and between 0.80 and 1.4 for aggregate gradations that are above the restricted zone.

**710.3.6 Moisture Sensitivity:** The resistance to moisture damage shall be evaluated in accordance with AASHTO T-283, "Standard Method of Test for Resistance of Compacted Bituminous Mixture to Moisture Induced Damage," without the optional freeze-thaw cycle. The asphalt concrete, at the design binder content, shall have a minimum average dry tensile strength of 500 kPa and a minimum tensile strength ratio of 0.70 when the aggregate gradation is below the restricted zone and a minimum average dry tensile of 750 kPa and a minimum tensile strength ratio of 0.60 when the aggregate gradation is above the restricted zone.

### 710.4 PRODUCTION TOLERANCES AND ACCEPTANCE:

Asphalt concrete from the mixing facility shall be accepted on the basis of acceptance tests of aggregate gradation, asphalt cement content, coarse/fine aggregates and volumetrics. Samples for acceptance tests will be taken by the Engineer or his representative at a minimum frequency of one sample for every 1,000 tons. The samples will be taken by the Engineer from behind the lay-down machine with a steel plate in accordance with Arizona Department of Transportation test method ARIZ 104b. The laboratory performing acceptance testing shall be accredited by the AASHTO Material Reference Laboratory (AMRL) in each of the tests used for acceptance. The acceptance samples shall be tested for unit weight and voids in accordance with ASTM D2041 and AASHTO T 166 or T 275 as applicable. The acceptance samples shall be tested for asphalt cement content, gradation, and uncompacted voids in accordance with ASTM D6307, C117, C136 and AASHTO TP304 Method A. Changes to the sampling and testing methods shall not be made without authorization from the Engineer.

Asphalt concrete not meeting the acceptance standards will be subject to removal, penalties, or other corrective action as described in sections 710.4.1, 710.4.2, 710.4.3 and 710.4.4 below. At the Engineer's discretion, requests may be considered to allow material whose test results indicate "removal" or "rejection" to remain in place. If such a request is made and the Engineer agrees to consider it, the contractor shall retain an independent asphalt technologist that is a registered Engineer in the State of Arizona, to perform an Engineering Analysis. The qualifications of the asphalt technologist are subject to the approval of the Engineer.

The Engineering Analysis shall discuss requirements and life expectancy of the pavement. Recommendations for corrective action necessary to bring the pavement to an acceptable condition must be provided in the Engineering Analysis. For the purposes of this analysis, "acceptable condition" will be defined by:

- Pavement condition rating typical of new pavements
- Structurally adequate for the pavement's design life (as defined by the specifying agency's pavement design methods). For the purposes of this specification, the pavement design life is the "analysis period" and is typically 20 years.
- Expected time frame before the first routine maintenance activity will be 7 years or more.

If the construction contract is directly with a party other than a public agency, as in the case of permits, and the test results are in the ranges that would normally indicate any penalty, removal or rejection, the contractor shall retain an independent asphalt technologist to recommend corrective action as described above.

If the contractor has reason to question the validity of any of the acceptance test results, he may request that the Engineer consider verification tests for final acceptance. Any request for verification testing must describe the Contractor's reasons for questioning the validity of the original acceptance results and must clearly describe which set of acceptance tests are in question. The Engineer may either accept or reject the request for verification testing.

If the Engineer accepts the request for verification testing, he will engage an independent laboratory who is accredited by AMRL or equivalent in all of the acceptance tests. The independent laboratory shall be paid by the Engineer and shall perform a completely new set of acceptance tests (as required by 710.4 representing the area or set of tests in question).

These tests shall include asphalt cement content, aggregate gradation, Marshall or Gyratory unit weight, and maximum theoretical unit weight. Samples for verification testing shall come from sample splits from the acceptance tests held by the acceptance laboratory, or from additional samples cored from the roadway. The Engineer will determine which samples will be used for verification testing.

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The number of samples taken will be in accordance with the Engineer's acceptance test frequency. The independent laboratory shall compile the test results and transmit them to both the Engineer and the Contractor. The independent laboratory shall include a letter signed by an Engineer registered in the State of Arizona, who is a specialist in asphalt concrete. The signed letter shall give an opinion that the material evaluated either does or does not comply with project specifications, and shall clearly describe any deficiencies.

If the difference in test results of the independent laboratory versus the original acceptance laboratory falls outside the multi-laboratory precision statements, for the test methods being used, the contracting Agency will bear the cost of the verification testing. If the difference in test results fall within the multi-laboratory precision statement, the cost for verification testing will be deducted from payments that were to be made to the Contractor. For test methods that do not have multi-laboratory precision statements, the cost for verification testing will be deducted from payments that were to be made to the contractor.

The Contractor shall remove any of the new pavement exhibiting bleeding, shoving or rutting and replace the asphalt concrete with new material meeting the specification requirements for the mix type involved. The width of the removal shall be wider than the roller width required for the replacement. The replacement shall be done any time within the one year warranty period for the project, and shall be done as many times as is necessary to correct the deficiency. Such replacement work shall be done at no additional cost to the contracting agency. The pavement will be considered to have rutted or shoved if measurements with an 8-foot straightedge indicate a depression in the pavement of 1/4 inch or more.

**710.4.1 Aggregate Gradation:** The Engineer at his discretion may accept the aggregate gradation on the basis of cold feed, hot bins, or by testing the aggregate after extraction by solvent or incineration methods. The testing shall be in accordance with AASHTO Designation T-11, "Standard Method of Test for Materials Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing" and AASHTO Designation T-27, "Sieve Analysis of Fine and Coarse Aggregates" or in accordance with AASHTO T-30, "Standard Method of Test for Mechanical Analysis of Extracted Aggregate," when solvent extraction or incineration methods are utilized to determine asphalt content.

The target values for all sieve sizes will be established by the mix design. The production tolerance for the gradation shall be tested against the following sieves: 0.075, 0.15, 0.6, 2.36, 4.75, 9.5, 12.5, 19, 25, 37.5 mm sieves. The aggregate gradation will be considered acceptable when the variations from the mix design percentages do not exceed the tolerances in Table 710-9 for a single event test. The full tolerance will be applied to the mix design percentages for acceptance. The restricted zone is considered a design requirement only.

| TABLE 710-9   |              |
|---|--------------|
| ALLOWABLE AGGREGATE VARIATION                       |              |
| Maximum Aggregate Size                              | 100% passing |
| Nominal Maximum Aggregate Size                      | ±7%          |
| 2.36 mm Sieve to the Nominal Maximum Aggregate Size | ±6%          |
| 0.150 mm and 0.600 mm Sieves                        | ±4%          |
| 0.075 mm Sieve                                      | ±2.0%        |

**710.4.2 Asphalt Cement Content:** The asphalt content may be determined in accordance with AASHTO Designation T-164, "Quantitative Extraction from Bituminous Paving Mixtures," AASHTO Designation T-287, "Asphalt Cement Content of Asphalt Concrete Mixtures by the Nuclear Method" or ASTM D6307 "Asphalt Content of Hot-Mix Asphalt by Ignition Method." The asphalt content determined by solvent extraction methods may be corrected for a retention value determined in accordance with ARIZ 407d, "Determination of Asphalt Retained in Bituminous Mixtures."

The Asphalt cement content shall be considered acceptable if it is within ±0.40% of the mix design target value. The Engineer will investigate variations beyond these limits with two additional core samples taken for each deficient acceptance test. Asphalt cement contents will be measured on the two core samples, and the average of all three tests shall be used to determine the asphalt cement content at that location.

When the asphalt cement content is outside of the ±0.40% tolerance by an amount from 0.0 to 0.2 percent points (by weight of the total mix), payment to the Contractor for asphalt concrete pavement will be reduced per Table 710.10. If the deviation is more

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than 0.2 percentage points, the materials represented by that test location will be removed and replaced at no additional cost to the contracting agency.

**TABLE 710-10**

**ASPHALT CEMENT CONTENT CORRECTIVE ACTION FOR DEVIATIONS**

| Deviation from that permitted | When the contracting agency is the owner:<br>Payment Reduction<br>(\$ per ton of asphalt concrete) | When the contracting agency is not the owner (i.e. permits):<br>Corrective Action |
|-------------------------------|--|---|
| 0.0 to 0.1% points            | \$0.50/ton   | No corrective action  |
| Over 0.1 to 0.2% points       | \$2.00/ton   | Remove & Replace*   |
| Over 0.2% points              | Remove & Replace*  | Remove & Replace*   |

\* The limits of the corrective action shall be over the affected area, but not less than the paver width (or 12 feet, whichever is more) and for a distance of 660 feet or the entire length of the affected roadway, whichever is less.

The following exception to Table 710-10 may be applied at the discretion of the Engineer. When the asphalt cement content is higher than that established in Subsection 710.4.2 but not beyond 0.2 percentage points, the payment reduction may be waived if the in-place air voids and the laboratory air voids (determined by gyratory or Marshall as applicable) fall within the following ranges. For “heavy” traffic mixtures, the laboratory void range shall be 2.8-6.2% and the in-place void range shall be 4.0-8.0%. For “low” traffic mixtures, the laboratory void range shall be 2.8-6.2% and the in-place void range shall be 3.0-7.0%.

**710.4.3 Coarse/Fine Aggregates:** The coarse/fine aggregate requirements shall be considered acceptable if the test values on production material falls within the mix design requirements established in Table 710-4, except for the uncompacted voids.

The uncompacted voids may be determined from collected samples in accordance with AASHTO TP-304, Method A, “(Test Method for Uncompacted Void Content of Fine Aggregate as influenced by Particle Shape, Surface Texture & Grading, Method A).” This result shall be calculated using the fine aggregate bulk oven dry specific gravity reported in the mixture design report. This same procedure may be performed on aggregate resulting from solvent extraction or incineration methods. The fine aggregate angularity shall be considered acceptable if the test value on production material is not less than the uncompacted voids specified on the mix design minus 1.5%.

**710.4.4 Volumetrics:** Procedures in the Asphalt Institute’s manual, MS-2 “Mix Design Methods for Asphalt Concrete” or the Asphalt Institute’s “Superpave<sup>TM</sup> Volumetric Mix Design Manual, SP-2” shall be used to determine the volumetrics. The volumetric values shall be considered acceptable if the test values on production material falls within the mix design criteria established in section 710.3.2 except for air voids.

The acceptance decision for air voids shall be based on Table 710-11.

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**TABLE 710-11**

| <b>LABORATORY VOIDS ACCEPTANCE AND PENALTIES</b>                                 |   |   |
|--|---|---|
| Laboratory Air Voids (Measured at N <sub>des</sub> 50 or 75 blows as applicable) | When the contracting agency is the owner:<br>Reduction in Payment<br>(\$ per ton of Asphalt Concrete) | When the contracting agency is not the owner (i.e. permits):<br>Corrective Action |
| Less than 1.5%   | Removal   | Removal   |
| 1.5-2.0%   | \$1.25  | Removal   |
| 2.1-2.7%   | \$0.50  | No corrective action  |
| 2.8-6.2%   | Full Payment  | No corrective action  |
| 6.3-6.9%   | \$0.50  | No corrective action  |
| 7.0-8.0%   | \$1.25  | Removal   |
| Greater than 8.0%  | Removal   | Removal   |

For the purposes of assessing the penalties in Table 710-10, each day's production will be considered one lot. The penalties will be applied to the payment for asphalt concrete pavement for the entire lot and will be based on the average values of the acceptance tests made for that lot.

### 710.5 PRODUCTION REQUIREMENTS:

**710.5.1 Quality Control:** Quality control shall be the responsibility of the Contractor or his supplier. The Engineer reserves the right to obtain samples of any portion of any material at any point of the operations for his own use. Also, the Engineer reserves the right to order the use of any drying, proportioning and mixing equipment or the handling of any material discontinued which, in his/her opinion, fails to produce a satisfactory mixture.

The asphalt concrete mix produced shall conform to the properties of the mix design. When the asphalt concrete mix does not conform to the approved mix design properties, the production shall cease immediately.

In addition to other quality control responsibilities, the Contractor/Supplier/Producer shall provide testing at the frequencies listed in Table 710-12 during production of asphalt concrete. A laboratory, accredited in each of the listed tests by the AASHTO Materials Reference Laboratory (AMRL), shall perform the testing. The laboratory facilities where the tests are performed shall be located at the plant producing the asphalt concrete for the project.

**TABLE 710-12**

| <b>CONTRACTOR QUALITY CONTROL TESTING REQUIREMENT</b>            |                                 |                              |
|--|---------------------------------|------------------------------|
| Test   | Sample Point                    | Frequency                    |
| Ignition Binder Calibration<br>ASTM D6307-98                     | Stockpiles & storage tanks      | 1 per mix design per project |
| Ignition Binder Content &<br>Gradation (ASTM D6307, C117 & C116) | Plant, truck, on-grade, etc.    | 1 per 1000 tons              |
| Gyratory or Marshall Density,<br>(ASTM D4013 or AASHTO T166)     | Plant, truck, on-grade, etc.    | 1 per 1000 tons              |
| Maximum Theoretical Density<br>(ASTM D2041)                      | Plant, truck, on-grade, etc.    | 1 per day                    |
| Temperature  | Storage silo or hot<br>elevator | Continuous Reading           |
| Aggregate Gradation (ASTM<br>C117 & C136)                        | Cold Feed                       | 1 per 750 Tons               |

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Results of each test shall be provided to the Engineer's representative immediately as they are completed, and in no case later than the end of the day the asphalt was produced. The contractor shall utilize the results of this testing to control the asphalt concrete production. Production of asphalt concrete on consecutive paving days shall not commence until the prior day's test results have been submitted to the Engineer, and the appropriate action has been taken regarding the criteria listed in Table 710-12 and Table 710.13.

The guidelines in Table 710-13 and Table 710.14 shall be used to determine if the plant will require adjustment or stoppage. If the contractor's test results indicate the mixture does not comply with Criteria A, an adjustment to the plant will be required which will bring the production closer to the middle of the specification bands. The Contractor is responsible for determining the extent and the method of adjustment, and shall notify the Engineer's representative in writing of what adjustments were made.

If the Contractor's test results indicate the mixture is beyond the range established by Criteria S in Table 710-13, production shall cease immediately, and shall not resume (except as required to produce material for additional samples) until additional test results verify the adjustments will produce test results meeting Criteria A. The Engineer reserves the right to enforce the adjustment or stoppage criteria to the acceptance test results if the acceptance tests and the quality control tests are not in agreement.

| <b>TABLE 710-13</b>                           |                         |                         |
|---|-------------------------|-------------------------|
| <b>CRITERIA FOR REQUIRED PLANT ADJUSTMENT</b> |                         |                         |
| Property                                      | Criteria A-(Adjustment) | Criteria S-(Stoppage)   |
| Binder Content                                | ±0.3% of Mix Design     | ±0.4% of Mix Design     |
| Gyratory Voids                                | 4±1.5%                  | 4±2.0%                  |
| Gradation                                     | Table 710-14 below      | Table 710-9 (MAG Specs) |
| Temperature                                   | ±10°C of Mix Design     | ±15°C of Mix Design     |

| <b>TABLE 710-14</b>   |       |
|---|-------|
| <b>ALLOWABLE GRADATION VARIATION FROM MIX DESIGN TARGET</b> |       |
| Maximum Aggregate Size                                      | 100%  |
| Nominal Maximum Aggregate Size (NMAS)                       | ±5%   |
| 2.36 mm Sieve to NMAS                                       | ±4%   |
| 1.50 mm and 0.66 mm Sieves                                  | ±3%   |
| 0.75 mm Sieve   | ±1.5% |

The Contractor may make self-directed target changes to the approved mix design within the limits in Table 710-15. Requests for self directed target changes shall be made in writing and acknowledged by the Engineer prior to start of production for a lot. The self-directed target changes must meet contract requirements for mix design criteria and grading limits.

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**TABLE 710-15**

### SELF DIRECTED TARGET CHANGES

| Measured Characteristics<br>Gradation (sieve size)(mm) | Allowable Target Changes |
|--|--------------------------|
| 9.50   | ±2%                      |
| 2.36   | ±2%                      |
| 0.425  | ±1%                      |
| 0.075  | None                     |
| Asphalt Cement Content                                 | ±0.2%                    |
| Effective Voids  | None                     |

The Contractor may propose target changes to the approved mix design for the engineer's approval. The Engineer will consider if the proposed target change will result in mix production that meets the contract requirements for mix design criteria and grading limits. For acceptance purposes, target changes will not be retroactive.

**710.5.2 Handling and Storage of Aggregate:** Aggregate shall be stockpiled so that segregation and contamination are minimized. Dividers of sufficient size to prevent intermingling of stockpiles shall be provided. This may be accomplished by sufficient separation of the stockpiles.

Any method of handling or moving the material which may cause the segregation, degradation, contamination or the combining of materials of different gradings or stockpiles shall not be permitted. The affected material will be reprocessed or discarded.

**710.5.3 Proportioning:** The Contractor or his supplier shall provide documentation by calibration charts or other approved means showing the mineral aggregate, asphalt cement, mineral admixture, mineral filler or anti-stripping agent are being proportioned in accordance with the approved mix design. One set of documentation shall be provided for each 750 tons produced, however not less than one per each time the plant is placed in production. All measuring devices shall be calibrated at least annually by a technician licensed by the Arizona Bureau of Weights & Measures. Copies of the calibration documentation shall be an integral part of the mix design approval process which, if not acceptable, could be cause for rejection of the entire submittal.

If a mineral admixture or anti-stripping agent is added in a drum mix plant, a positive signal system and a limit switch device shall be installed in the plant at the point of introduction of the admixture. The positive signal system shall be placed between the metering device and the mixing drum, and utilized during production, whereby the mixing shall be stopped automatically if the admixture is not being introduced into the mixture.

No fine material which has been collected in the dust collection system shall be returned to the mixture unless the Contractor or his supplier propose in writing to utilize a specific portion of the fines and approved by the Engineer. If used, the fine material shall be metered at a uniform rate into the mixture.

When mineral filler is added to the asphalt mix, it shall be added prior to the asphalt cement. Also, the method of adding the mineral filler shall produce a uniform distribution without loss or waste of the material within the mixture. The amount of mineral filler shall be determined by the mix design.

Filler material, if required, shall be added separately and in a thoroughly dry condition. Heating of filler material will not be required.

When hydrated lime or Portland cement is added as a mineral admixture or anti-stripping agent, the method of adding the lime or cement shall be such that the aggregate will be uniformly coated. The amount of lime or cement used shall be determined by the mix design.

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When mineral aggregate, asphalt cement, mineral filler, mineral admixture or anti-stripping agent are proportioned by weight, the scales used in batching the materials, all boxes, hoppers, buckets or similar receptacles used for weighing materials, shall be insulated against the vibration or movement from the rest of the plant. Errors in weighing, while the entire operation is running, shall not exceed two percent for any setting nor one and one-half percent for any batch. The asphalt shall be weighed in a heated, insulated bucket suspended from a springless dial scale or load cell system.

When mineral aggregate, asphalt cement, mineral filler, mineral admixture and/or anti-stripping agent are proportioned by volume, the correct portion of each mineral aggregate size introduced into the mixture shall be drawn from the storage bins by an appropriate type of continuous feeder. The feeder shall supply the correct amount of mineral aggregate in proportion to asphalt cement. Furthermore, the feeder shall allow each mineral aggregate size to be adjusted separately. The continuous feeder for the mineral aggregate shall be mechanically or electrically actuated.

If fine material sticks to the sides of the bin, the bin shall be equipped with vibrating unit which will effectively vibrate the side walls of the bin and prevent any hang up of segregated sizes while the plant is operating.

All scales or temperature devices shall be so located that the mixer operator and the plant inspector have an unobstructed close-up-view of the indicating or registering devices. The scales shall indicate the true net weight without the application of any factor. The dial for dial type scales shall not be less than 12 inches in diameter and the figures thereon shall be clearly legible.

**710.5.4 Drying and Heating:** The mixing plant shall be provided with accurate mechanical means for feeding the aggregates from the stockpiles or bunkers into the drier at such a rate that a uniform production and temperature of dried aggregates will be obtained. Drying and heating shall be accomplished in such a manner as to preclude the mineral aggregate from becoming coated with fuel oil or carbon.

A recording pyrometer or other approved recording thermometric instrument, sensitive to a rate of temperature change not less than 6° C. per minute, shall be placed at the discharge chute of the drier to automatically record the temperature of the asphalt concrete or mineral aggregate. When requested, a copy of the recording shall be given to the Engineer at the end of each shift. The mixing temperature of the asphalt mix shall not exceed  $\pm 10^{\circ}\text{C}$ . of the mixing temperature stated on the approved mix design.

Heating of filler material will not be required.

Drying shall be to the extent that the moisture content of the asphalt concrete mix, when placed on grade immediately behind the paver, shall not exceed one half of one percent (0.5 %). The moisture content shall be determined in accordance with Arizona Test Method 406.

The drier shall be equipped with a dust collector system capable of removing objectionable or excess dust from the aggregate. The dust collector shall comply with the Maricopa County Bureau of Air Pollution Control Rules and Regulations as adopted by the County Board of Supervisors and applicable State laws or local ordinances.

**710.5.5 Mixing:** The production of the plant shall be governed by the rate required to obtain a thorough and uniform mixture of the materials not to exceed the rated capacity of the plant. Mixing shall continue until the uniformity of coating, when tested in accordance with the requirements of AASHTO T-195, is at least 95 percent.

The mineral aggregate, asphalt cement, mineral filler, mineral admixture and/or anti-stripping agent shall be mixed at a central mixing plant of the batch type mixer, continuous type mixer, or drum type mixer, as the Contractor or his supplier may elect. The plant shall be maintained and operated in accordance with the manufacturer's recommendations.

Pug mill mixers shall be of a twin-shaft type and shall be operated at the speed recommended by the manufacturer. It shall be equipped with paddles of sufficient size and number to deliver a thorough and uniform mixture. Should the paddles or other parts of the pug mill become worn to such extent as to adversely affect the quality of the mixing or allow leakage from the discharge gate, such parts shall be promptly replaced.

The amount of asphalt cement to be added to the mineral aggregate shall be as specified in the mix design. The asphalt cement shall be added at the temperature specified in the mix design or in Section 711.

The asphalt pump shall be a positive displacement type pump. The use of a pressure relief valve will not be permitted. The plant shall be equipped with an indicating meter between the pump and spray, and the meter shall be in good working condition and

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accurately record the volume of material pumped. All pipes, bins, fittings and meters shall be steam jacketed or otherwise properly insulated. The asphalt storage system shall be equipped with a device for automatic plant cut-off when the intake of the positive displacement pump is not working under positive pressure. Sampling ports shall be installed at the discharge end of the metering device for use by the Engineer in obtaining samples of the material.

A positive signal system shall be provided to indicate the low level of mineral aggregate in the bins of the batch plant and as the level of material in any one bin approaches the strike off capacity of the feed gate, the device will automatically and promptly close down the feed of all materials to the mixer. The plant will not be permitted to operate unless this signal system is in good working condition. Each bin shall have an overflow chute or divider to prevent material from spilling into adjacent bins or waste excess material.

The temperature of the asphalt concrete upon discharge from the mixer shall not exceed the maximum mixing temperature specified in the mix design. If the asphalt concrete is discharged from the mixer to a hopper, the hopper shall be constructed so that segregation of the asphalt concrete will be minimized.

**710.5.6 Temporary Storage of Bituminous Mixtures:** Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted. The bituminous mixture may be stored in insulated and heated storage bins for a period of time not to exceed 12 hours. If the Engineer determines that there is an excessive amount of heat loss, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

**710.5.7 Plant Inspection:** Each hot mix asphalt facility, producing under this specification, shall be inspected biannually by a Civil Engineer registered in the State of Arizona and knowledgeable in batch plant operation. The Civil Engineer shall be independent and not an employee of the Contractor or the supplier. This inspection shall be performed in accordance with the "Certification of Hot Mix Asphalt Production Facilities" by the Arizona Rock Products Association. A copy of the current certification shall be an integral part of the mix design which, if found unacceptable, could be cause for rejection of the entire submittal.

### **710.6 TRANSPORT AND DELIVERY REQUIREMENTS:**

The beds of the trucks, utilized to transport asphalt concrete, shall be coated with a release agent. The release agent shall be certified to be non-reactive with the bituminous material. If, in the opinion of the Engineer or plant operator, there is an excess of release agent applied to the truck bed, the driver will be required to raise the bed and drain off the excess agent. Diesel fuel will not be acceptable as a releasing agent.

Mixtures shall be delivered to the job site without segregation of the ingredients and within the lay down temperature range specified in the mix design.

At the time of delivery to the job site, the Engineer shall be provided with an legible delivery ticket that has the weight of the material from a measuring device, which has been certified by the Arizona Department of Weights and Measures. The delivery ticket shall contain the following information:

(1) Date; (2) Supplier's name; (3) Plant location and/or plant number; (4) Ticket Number; (5) Truck Number; (6) Contractor's name; (7) Project name and/or location; (8) Production code/description with percent asphalt; (9) Mineral filler/additive and/or anti-stripping agent and percent; (10) Temperature at batching; (11) Time of batching, arrival and unloading; (12) Material weight or vehicle weight with and without material; and (13) Weight of accumulative loads.

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End of Section

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**SECTION 718**  
**PRESERVATIVE SEAL FOR ASPHALT CONCRETE**

**718.1 GENERAL:**

Asphalt concrete preservative seal shall be one of the following types or equal, with typical application rates.

**Type A** - Petroleum resin-oil base emulsion. Applied at 0.05 to 0.10 gallons per square yard, diluted.

**Type B** - Petroleum Hydrocarbon emulsion. Applied at 0.05 to 0.20 gallons per square yard, diluted.

**Type C** - Not Used.

**Type D** - Acrylic polymer, modified asphalt emulsion. Applies at 0.10 to 0.20 gallons per square yard, diluted as specified by the manufacturer.

**718.2 TEST METHODS AND REQUIREMENTS:**

Preservative seal shall meet Type A, B, or D on Table 718-1 by certification from the manufacturer.

| <b>TABLE 718-1</b>  |               |               |               |                                     |
|---|---------------|---------------|---------------|-------------------------------------|
| <b>PRESERVATIVE SEAL SPECIFICATIONS</b>                     |               |               |               |                                     |
| <b>Property and Test Method*3</b>                           |               | <b>Type A</b> | <b>Type B</b> | <b>Type D</b>                       |
| Saybolt Viscosity @ 77°F SFS                                | AASHTO T 72   | 15-40         | 25-150        | 15-40 *(1-3)                        |
| Residue by evaporation at 138°C                             | AASHTO T 59   | 60 Min.       | 62 Min.       | 53 Min.                             |
| Sieve Test, %   | AASHTO T 59   | 0.10 Max.     | 0.10 Max.     | 0.10 Max.                           |
| Particle Test   | AASHTO T 59   | Positive      | Positive      | Positive                            |
| 5 Day Settlement  | AASHTO T 59   |               | 2.0%          | 5.0% Max.                           |
| Tests on Residue From Evaporation AASHTO T 59               |               |               |               |                                     |
| Kinematic Viscosity c.St @ 140EF                            | ASTM D2170    | 100-200       | 1,000-        | *(1-3)                              |
| Flash Point   | ASTM D92      | 400°F         | 450°F         | 450°F                               |
| Softening Point, °F   | AASHTO T 53   |               |               | 130°Min.                            |
| Penetration @77°F 100 g/5 sec., dmm                         | AASHTO T 49   |               |               | 20-80                               |
| Ductility @ 77°F, 5 cm/min, cm                              | AASHTO T 51   |               |               | 20 Min.                             |
| Asphaltenes   | ASTM D2007    | 1.0 Max       | 10.0 Max      |                                     |
| Maltene Dist Ratio (PC+A <sub>1</sub> )/(A <sub>2</sub> +S) | ASTM D2007    | 0.3 - 0.6     | 0.2 - 1.4     |                                     |
| Saturated Hydrocarbons, S, %                                | ASTM D2007    | 28 Max.       | 28 Max.       |                                     |
| PC/S Ratio  |               | 0.5 Min.      | 0.5 Min.      |                                     |
| Accelerated Weathering Test                                 | ASTM D4799-03 |               |               | Plant Certification within 6 months |

\*Notes:

(1) Only residue by evaporation should be run on diluted samples. Specification limits should be diluted rate times minimum residue value of concentrate.

(2) A full series of tests shall be performed as specified by the special provisions in the undiluted condition and at the expense of the contractor. Otherwise, the agency shall perform any tests at the expense of the agency.

(3) All testing will be run by AMRL accredited laboratory, accredited in the specific test being run.

## SECTION 719

### RECYCLED ASPHALT CONCRETE HOT MIXED

#### 719.1 GENERAL:

Recycled asphalt concrete (RAC) shall consist of reclaimed asphalt pavement, new aggregate and paving asphalt and/or recycling agent. This mixture shall be combined at a central mixing plant to provide a homogenous, workable product. This product shall meet the requirement of Section 710, based on the type specified, for aggregate gradation, asphalt grade and asphalt content.

Prior to the use of RAC on any project, the Contractor shall notify the Engineer of his intentions and shall make available the test reports required in Section 709 and a mix design as required by this section. Unless written authorization is given by the Engineer, RAC will not be used in the surface course or single course pavement. If the Contractor fails to comply with the above procedures or with the intent of Section 709 and this section, the RAC will be removed and replaced with asphalt concrete at no cost to the Contracting Agency.

When the amount of RAP is 15 percent or less of the total mix, the supplier shall maintain a job mix formula at the plant. The formula shall be based on current test data and approved by the Engineer.

When the amount of RAP to be added is over 15 percent of the total mix, a job mix formula and supporting test data shall be submitted to the Engineer for approval at least 8 working days prior to use. The supporting test data for the RAC shall include the results of tests for stability, swell, and moisture vapor susceptibility. These tests are in addition to the tests for the RAP stockpile specified in Section 709.

After the job mix formula has been approved, the mixing plant designated and the RAP stockpile(s) approved, the Contractor and/or his Supplier shall not change any of the above or utilize additional mixing plants or stockpiles without prior approval of the Engineer.

#### 719.2 MATERIALS:

**719.2.1 Aggregate:** New aggregate shall conform to Section 710.

**719.2.2 Reclaimed Asphalt Pavement:** Shall conform to section 709.

**719.2.3 Asphalt:** New asphalt shall conform to Section 711.

**719.2.4 Mineral Filler:** Shall be dry hydrated lime or portland cement.

**719.2.5 Recycling Agent (RA):** Shall comply with Table 719-1.

| TABLE 719-1   |                  |              |     |              |      |              |       |              |       |              |       |
|---|------------------|--------------|-----|--------------|------|--------------|-------|--------------|-------|--------------|-------|
| RECYCLING AGENTS                                    |                  |              |     |              |      |              |       |              |       |              |       |
| TEST  | ASTM Test        | RA 5         |     | RA 25        |      | RA 75        |       | RA 250       |       | RA 500       |       |
|   | Methods          | Min          | Max | Min          | Max  | Min          | Max   | Min          | Max   | Min          | Max   |
| Viscosity at 140°F. (60°C).<br>CST                  | D2170 or<br>2171 | 200          | 800 | 1000         | 4000 | 5000         | 10000 | 15000        | 35000 | 40000        | 60000 |
| Flash Point, COC.<br>F. (°C) Min                    | D92              | 400<br>(204) |     | 425<br>(218) |      | 450<br>(232) |       | 450<br>(232) |       | 450<br>(232) |       |
| Saturates Wt.<br>% Max                              | D2007            | 30           |     | 30           |      | 30           |       | 30           |       | 30           |       |
| Residue from RTFO<br>Oven Test at<br>325°F. (163°C) | D2872            |              |     |              |      |              |       |              |       |              |       |
| Viscosity Ratio <sup>2</sup> Max                    | —                | 3            |     | 3            |      | 3            |       | 3            |       | 3            |       |
| RTFO Oven Weight Change<br>±, %                     | D2872            | 4            |     | 3            |      | 2            |       | 2            |       | 2            |       |
| Specific Gravity                                    | D 70 or<br>D1298 | Report       |     | Report       |      | Report       |       | Report       |       | Report       |       |

## SECTION 738

### HIGH DENSITY POLYETHYLENE PIPE & FITTINGS FOR STORM DRAIN & SANITARY SEWER

#### 738.1 GENERAL:

This specification covers the requirements of profile-reinforced and corrugated (Type S or Type D) high density polyethylene (HDPE) pipe manufactured per ASTM F-894, AASHTO M-252 or AASHTO M-294 for gravity flow, low pressure storm drain and sanitary sewer systems. When noted on the plans or in the special provisions, gravity flow, low pressure storm drains and sanitary sewers may be constructed using HDPE pipe. The HDPE pipe will be of the sizes 8 inch diameter through 120 inch diameter. For the purpose of this specification, low pressure is defined as the test pressures of 3.5 psi of air or 4 feet of water as specified in Section 615.10.

All pipe joints shall conform to the controlled pressure test of 10.8 psi of air or 25 feet of water as stipulated in ASTM D-3212.

The size and class of the HDPE pipe to be furnished shall be designed by the Engineer and shown on the plans or in the project specifications. At no time will the class designed be less than RSC-63 for profile pipe, or minimum equivalent Pipe Stiffness (PS) for corrugated pipe per the requirements of AASHTO M-252 or AASHTO M-294.

#### 738.2 MATERIALS:

**738.2.1 Base Material Composition:** Profile pipe base material and fittings shall, in accordance with ASTM F-894, be made from a PE plastic compound meeting the requirements of Type III, Class C, Category 5, Grade P34 as defined in ASTM D-1248 and with established hydrostatic design basis (HDB) of not less than 1250 psi for water at 73.4 degrees F. as determined in accordance with Method ASTM D-2837. Materials meeting the requirements of cell classification PE 334433 C or higher cell classification, in accordance with ASTM D-3350 are also suitable. Corrugated pipe base material shall comply with the requirements of AASHTO M-252 (Type S) or AASHTO M-294 (Type S or D) and have a minimum cell classification PE 335420C.

**738.2.2 Other Pipe Materials:** Materials other than those specified under Base Materials shall comply with ASTM F-894, AASHTO M-252 or AASHTO M-294.

**738.2.3 Gaskets:** Rubber gaskets shall be manufactured from a natural rubber, synthetic elastomer or a blend of both and shall comply in all respects with the physical requirements in ASTM F-477.

**738.2.4 Water Stops:** Water stops shall be manufactured from a natural or synthetic rubber and shall conform to the requirements of ASTM C-923. The water stop shall have expansion rings, a tension band, or a take-up device used for mechanically compressing the water stop against the pipe.

**738.2.5 Thermal Welding Material:** The material used for thermally welding the pipe material shall be compatible with the base material.

**738.2.6 Lubricant:** The lubricant used for assembly shall comply to manufacturer's recommendations and have no detrimental effect on the gasket or pipe.

#### 738.3 JOINING SYSTEMS:

**738.3.1 Gasket Type:** Joints for the piping system and fittings shall consist of an integrally formed bell and spigot gasketed joint. The joint shall be designed so that when assembled, the elastomeric gasket located on the spigot is compressed radially on the pipe or fitting bell to form a water tight seal. The joint shall be designed so to prevent displacement of the gasket from the joint during assembly and when in service. The elastomeric gasket shall meet the provision of ASTM F-477.

All pipe shall have a home mark on the spigot end to indicate proper penetration when the joint is made.

The bell and spigot configurations for the fittings shall be compatible to those used for the pipe.

## SECTION 738

Joints shall provide a seal against exfiltration and infiltration. All surfaces of the joint upon which the gasket may bear, shall be smooth and free of any imperfections, which would adversely affect sealability.

The assembly of the gasketed joints shall be in accordance with the pipe manufacturer's recommendations.

**738.3.2 Thermal Weld Type:** The pipe ends shall consist of an integrally formed bell and spigot, with or without the elastomeric centering gasket, which join together to form an interface between bell and spigot, such that it is suitable to seal by thermal weld using the extrusion welding process, in accordance with the manufacturer's recommended procedure.

Thermal welded joints may be effected by welding from inside the pipe or outside, or both.

The assembly of the welded joints shall be in accordance with the manufacturer's recommendations.

Thermal welded joints shall be used only when specified on plans or in specifications.

### 738.4 FITTINGS:

Fittings for HDPE profile wall or corrugated pipe may include tees, elbows, manhole adapter rings, plugs, caps, adapters and increasers. Fittings shall be joined by gasket type or thermal weld type joints in accordance with Subsection 738.3

A clamp gasket or approved method shall be provided at manhole entry or connection to reduce infiltration and exfiltration. Where precast manholes are used, entrance holes must be large enough to allow for proper grouting around the manhole gasket. A non-shrink grout shall be used for grouting.

### 738.5 CERTIFICATION:

The manufacturer shall furnish an affidavit (certification) that all materials delivered shall comply with the requirements of ASTM F-894 or AASHTO M-252.

Pipe and resin producers that manufacture according to AASHTO M-294 shall be certified according to the Plastic Pipe Institute protocol for their Third Party Certification Program.

### 738.6 DIMENSIONS AND TOLERANCES:

Profile wall HDPE pipe dimensions shall comply with dimensions given in Table 1 of ASTM F-894. The "average or nominal inside diameter" of profile wall HDPE pipe shall not deviate from its normal pipe size by more than as specified in Table 1 of ASTM F-894. Corrugated HDPE pipe dimensions shall be "nominal inside diameter" dimensions and shall not deviate from its nominal pipe size by more than the minimum and maximum tolerances as described in AASHTO M-252 or AASHTO M-294, Section 7.2.3.

Profile pipe shall have a Ring Stiffness Constant (RSC) or Pipe Stiffness (PS) as shown on the plans. The minimum RSC for profile HDPE pipe shall be RSC-63. The minimum PS for corrugated pipe shall be as shown in AASHTO M-252 (Section 7.5) or AASHTO M-294 (Section 7.4), and tested per ASTM D-2412. In no case shall the minimum PS be less than the equivalent PS value for RSC-63.

### 738.7 CLASSIFICATIONS:

HDPE profile-reinforced pipe products shall be made in four standard Ring Stiffness Constant (RSC) classifications, 40, 63, 100 and 160. These are referred to as RSC-40, RSC-63, RSC-100 and RSC-160. The RSC test shall be conducted in accordance with ASTM D-2412 with the exceptions listed in accordance with ASTM F-894. HDPE corrugated pipe (Type S or Type D) shall meet the minimum Pipe Stiffness (PS) requirements of AASHTO M-252 or AASHTO M-294. The PS test shall be conducted in accordance with ASTM D-2412 with the exceptions listed in accordance with AASHTO M-252 or AASHTO M-294.

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### 738.8 MARKINGS:

Markings on pipe shall be per ASTM F-894, AASHTO M-252 or AASHTO M-294. These markings shall be clearly shown on the pipe at intervals of approximately 12 feet and include but not limited to the following: the manufacturer's name or trademark, nominal size, the specification designation, plant designation code, date of manufacture or an appropriate code. All fittings shall be marked with the designation number of the specification and with the manufacturer's identification symbol. In addition, manufacturers of corrugated HDPE, AASHTO M-294, shall print on or affix the appropriate Plastic Pipe Institute Program Mark on each length of pipe produced that meets the requirements of the program.

### 738.9 CARE OF PIPE AND MATERIALS:

Care of pipe materials shall comply with Subsection 736.5.

HDPE profile reinforced RSC type pipe in shipping or storage shall not be stacked higher than three rows for pipes 21 inches in diameter or less, nor higher than two rows for pipes 24 to 36 inches in diameter inclusive. Pipe shall not be stacked, shipped, or stored with weight on the bells of the pipe.

Corrugated HDPE pipe in shipping and storage shall be stacked per manufacturer's recommendation, but in no case higher than 5 rows for pipe 24 inches or less in diameter, or 3 rows for pipe greater than 24 inches in diameter.

Pipe that is gouged, marred, or scratched forming a clear depression shall not be installed and shall be removed if damaged in the installation.

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End of Section





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